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See attached issues

PIT CLEANUP PROGRAM FOR THE PENNSYLVANIA SITES

Texas Eastern Gas Pipeline Company
Houston, Texas

January 28, 1988

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SECTION 1

INTRODUCTION

1.1 BACKGROUND

On April 1, 1987, Texas Eastern Transmission Corporation and its division Texas Eastern Gas Pipeline Company (Texas Eastern) entered into a Consent Order and Agreement (Consent Order) with the Commonwealth of Pennsylvania, Department of Environmental Resources (Department). In compliance with the Consent Order, Texas Eastern is performing an investigation of potential environmental contamination at 18 station sites located in Pennsylvania. The 18 station sites included in the Consent Order are collectively referred to in Paragraph C of the Consent Order as the "Pennsylvania Sites" and are listed in Table 1-1. The locations of the Pennsylvania Sites are shown in Figure 1-1.

Paragraph 15(b) of the Consent Order requires Texas Eastern to submit to the Department a plan to clean up the unlined earthen condensate pits (pits) described in Paragraph G of the Consent Order. This pit cleanup plan for the Pennsylvania Sites is being submitted to the Department within 120 days of completion of the soil boring program for the pits conducted in compliance with Paragraph 15(a) of the Consent Order. The following reports pertaining to the pits were submitted to the Department in compliance with Paragraphs 12 and 15(a) of the Consent Order:

- Revised Report Identifying Pits, Ponds, Lagoons, and Disposal Pits at the Pennsylvania Sites (Texas Eastern, July 29, 1987).
- Summary Report for the Soil Boring Program at Sixteen Pennsylvania Sites (WESTON, August 11, 1987).
- Chlorinated Dibenzo-p-dioxin/Chlorinated Dibenzofuran Data for Composite Soil Boring Samples at Sixteen Pennsylvania Sites (WESTON, September 30, 1987).

Based upon the information presented in the above referenced reports and the dates of their submission to the Department, the pit cleanup plan was to be submitted to the Department by January 28, 1988. However, due to a one-day extension granted by the Department (letter from J. Robert Stoltzfus to Marc Gold of 27 January 1988), this pit cleanup plan is being submitted

Table 1-1

List of the Pennsylvania Sites

Station Name	Station Code	County
Armagh	ARM	Indiana
Bechtelsville	BEC	Berks
Bedford	22A	Bedford
Chambersburg	023	Franklin
Connellsville	21A	Fayette
Delmont	DEL	Westmoreland
Eagle	025	Chester
Entriken	ENT	Huntingdon
Grantville	GRA	Dauphin
Holbrook	HOL	Greene
Lilly	LIL	Cambria
Marietta 24	024	Lancaster
Marietta 24A	24A	Lancaster
Perulack	PER	Juniata
Rockwood	022	Somerset
Shermans Dale	SHE	Perry
Uniontown	021	Fayette
Wind Ridge	020	Greene

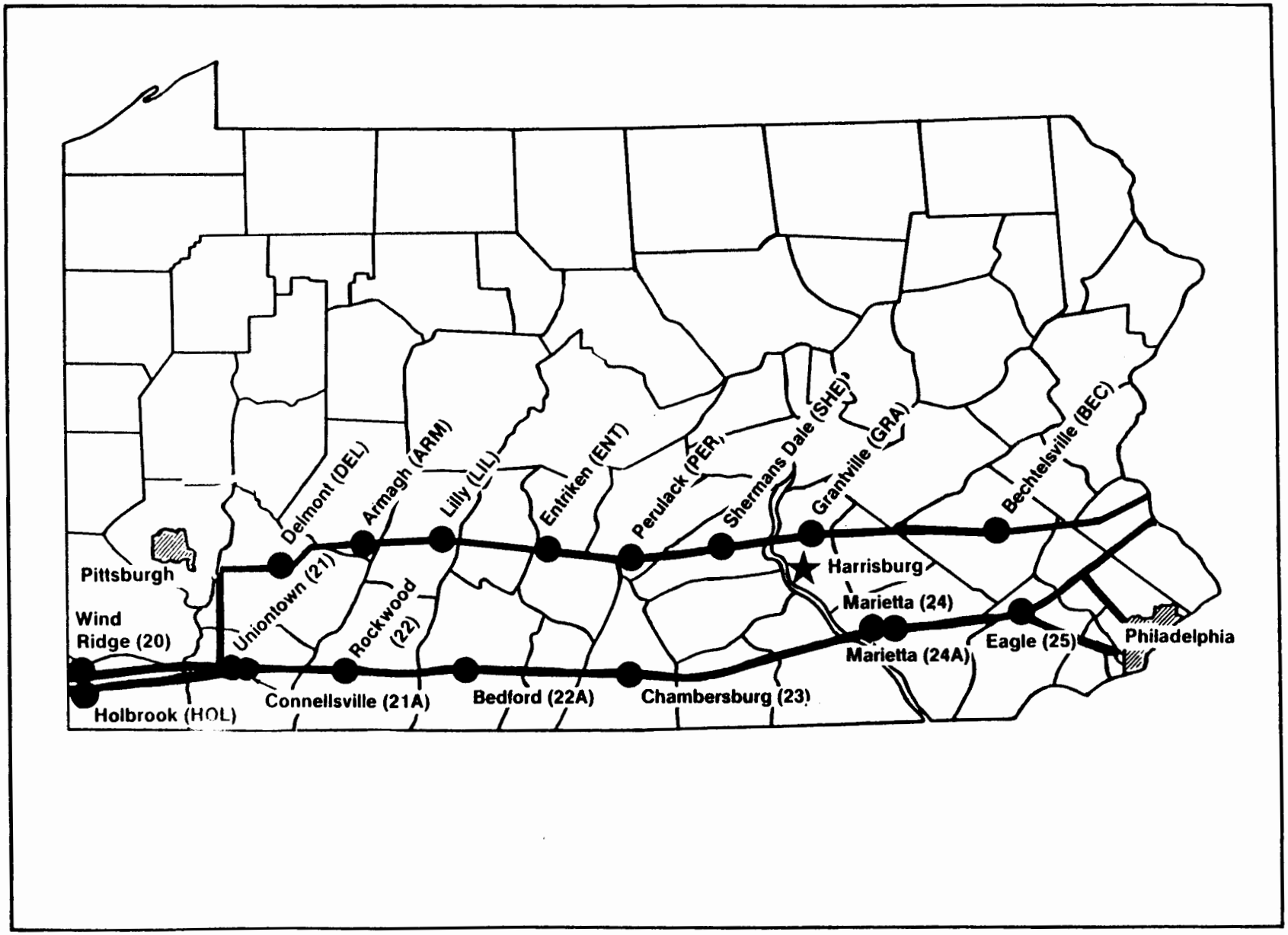


FIGURE 1-1 LOCATIONS OF THE PENNSYLVANIA SITES

WESTON

on January 29, 1988. Paragraph 15(b) of the Consent Order requires that the cleanup plan for the pits include the following:

- Detailed cleanup criteria for the pits.
- Consideration of recognized alternative cleanup methods and standards for the pits.
- An evaluation of a cleanup alternative that would result in the removal of all soils in the pits with detectable concentrations of PCBs.
- Verification sampling of soil immediately adjacent to the perimeter of the pits.

Texas Eastern has developed a cleanup approach for the pits at the Pennsylvania Sites that have been sampled and characterized in accordance with the soil boring program for the pits. A summary of the pits identified and pits investigated at the Pennsylvania Sites is provided in Table 1-2.

1.2 TECHNICAL APPROACH FOR PIT CLEANUP PLANS

This plan discusses the cleanup program for the pits. Section 2 of this plan summarizes the pit characterization data obtained during the soil boring program. Section 3 presents a discussion of the cleanup criteria and provides estimated soil volumes for the pits. Section 4 contains a screening of potential treatment/disposal technologies for cleanup of the soils in the pits. Section 5 presents an approach and procedure for cleanup of the pits from the development of site safety plans through verification sampling and pit closure.

WESTON and Texas Eastern believe that a media-specific (i.e., pits only) cleanup plan cannot be used in a practical manner to implement an effective cleanup action at a site. The most technically sound, environmentally responsive, and cost-effective approach to the cleanup of the Pennsylvania Sites will involve the preparation of comprehensive, site-specific cleanup plans addressing the contaminants of concern and relevant media followed by the implementation of a unified, coordinated cleanup of the site.

This approach facilitates the development of site-wide cleanup objectives and the selection of appropriate cleanup alternatives with consistent cleanup technologies. In addition, this approach will ensure that cleanup at a site will occur in an integrated, timely, and efficient manner.

Table 1-2

Summary of the Pits at the Pennsylvania Sites

Site	Pits Identified[1]	Pits Investigated[2]
Armagh	PA-ARM-01 PA-ARM-02	PA-ARM-01 PA-ARM-02
Bechtelsville	PA-BEC-01	PA-BEC-01
Bedford	PA-22A-01	PA-22A-01
Chambersburg	PA-023-01 PA-023-FF[3]	PA-023-01
Connellsville	PA-21A-01 PA-21A-02 PA-21A-03 PA-21A-04	PA-21A-01 PA-21A-02 PA-21A-03 PA-21A-04
Delmont	PA-DEL-01 PA-DEL-02[3] PA-DEL-04[3]	PA-DEL-01
Entriken	PA-ENT-01	PA-ENT-01
Grantville	PA-GRA-01	PA-GRA-01
Holbrook	PA-HOL-01 PA-HOL-02 PA-HOL-03	PA-HOL-01 PA-HOL-02 PA-HOL-03
Lilly	PA-LIL-01	PA-LIL-01
Marietta 24	PA-024-01	PA-024-01

[1]Pipeline liquid, fire fighting, and unknown pits identified in the July 29, 1987, letter from S. L. Horton of Texas Eastern to Donald A. Lazarchik of the Department.
[2]Pits investigated during the 8 Pilot Site Program and the Pit Soil Boring Program under Paragraph 15(a) of the Consent Order.
[3]Texas Eastern will propose a program for characterizing these pits in conformance with the pit characterization program, Paragraph 15(a), of the Consent Order.

Table 1-2
(continued)

Site	Pits Identified[1]	Pits Investigated[2]
Marietta 24A	PA-24A-01 PA-24A-FF[3]	PA-24A-01
Perulack	PA-PER-01 PA-PER-02	PA-PER-01 PA-PER-02
Rockwood	PA-022-01	PA-022-01
Shermans Dale	PA-SHE-01 PA-SHE-02	PA-SHE-01 PA-SHE-02
Uniontown	PA-021-01	PA-021-01
Wind Ridge	PA-020-01 PA-020-02	PA-020-01 PA-020-02

[1]Pipeline liquid, fire fighting, and unknown pits identified in the July 29, 1987 letter from S. L. Horton of Texas Eastern to Donald A. Lazarchik of the Department.
[2]Pits investigated during the 8 Pilot Site Program and the Pit Soil Boring Program under Paragraph 15(a) of the Consent Order.
[3]Texas Eastern will propose a program for characterizing these pits in conformance with the pit characterization program, Paragraph 15(a), of the Consent Order.

A coordinated one-time cleanup action at each Pennsylvania Site is recommended for the following reasons:

- It will involve mobilization/demobilization at a site only once.
- It will require obtaining permits and approvals only once.
- It will enable the Department to better manage any oversight obligations.
- It will create a minimum impact on surrounding communities.
- It will cause a minimum of disruption to Texas Eastern's site operations.

WESTON and Texas Eastern believe that the unified approach to preparation and implementation of comprehensive, site-specific cleanup plans can be achieved within the requirements of the Consent Order through a process of integration as shown schematically in Figure 1-2. Upon sequential completion of the onsite soil, offsite soil, and sediment sampling programs, integration will be performed to develop a comprehensive, site-specific characterization database for soils, a set of site-wide cleanup objectives, a set of screened technologies, and a site-specific cleanup approach. In addition, the screened technologies will be used to formulate cleanup alternatives that will be evaluated based upon technical and institutional considerations to select the preferred cleanup alternative(s) on a site-specific basis. The selection of the preferred cleanup alternative(s) will be followed by the development of overall site-specific cleanup plans.

Based on the above discussion, WESTON and Texas Eastern propose the use of the unified approach within the requirements of the Consent Order to develop site-specific cleanup plans for coordinated one-time implementation at each Pennsylvania Site.

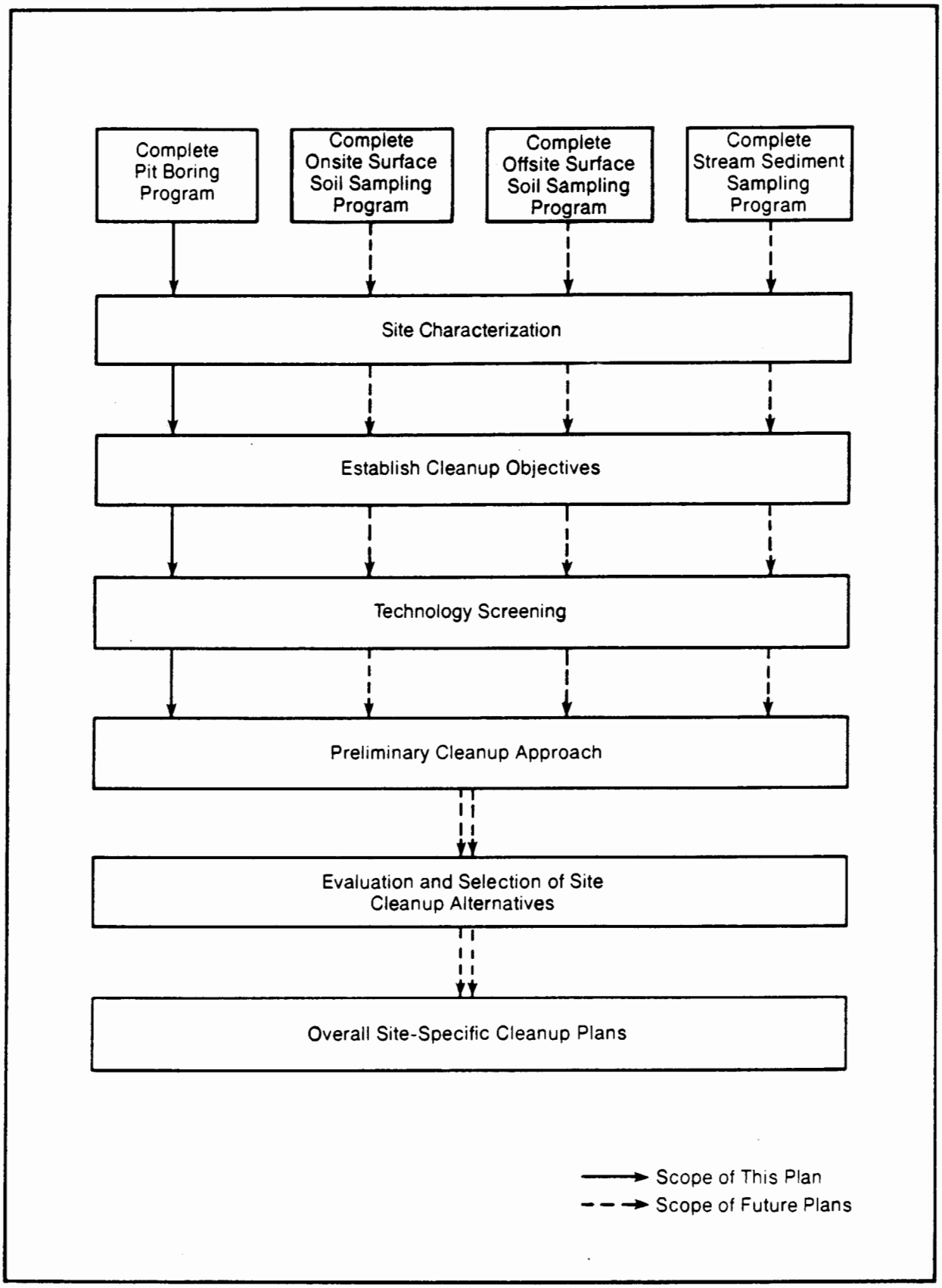


FIGURE 1-2 UNIFIED APPROACH TO DEVELOPMENT OF SITE-SPECIFIC CLEANUP PLANS

SECTION 2

PIT CHARACTERIZATION

2.1 INTRODUCTION

This section summarizes the pit characterization data obtained from the soil boring program conducted at the Pennsylvania Sites. A discussion of the analytical results for the pits is provided as well as information on the history of construction and use of the pits.

2.2 HISTORY AND DESCRIPTION OF THE PITS

As part of past operations at the Pennsylvania Sites, Texas Eastern used the pits primarily for collecting pipeline liquids. The pits were constructed onsite by excavating soil using conventional construction equipment. Earthen berms were constructed adjacent to the perimeter of the pits. Based on historical information, many of the pits were circular in shape and had diameters ranging from 10 to 40 feet. The pits ranged in depth from 4 to 8 feet. Figure 2-1 depicts a typical cross section for an open (i.e., previously active) pit.

Historically, the pits at the Pennsylvania Sites were used to accumulate pressurized, pipeline liquids drained from gas/liquid separators and incoming pipeline pig runs. Used lubricating oils collected from external drips or seeps from compressors and prime movers, and used oils from other operations at the site were also placed in the pits. Some pits were also used to train personnel in fire fighting techniques.

The pits were constructed at various times during the early stages of operation at the sites. The pits were unlined and open during their periods of operation. Liquid handling facilities were later constructed at the compressor stations which eliminated the need for the pits. Parts of some pits were temporarily kept in use for fire training.

All pits at the Pennsylvania Sites are now closed. Closure of the pits was accomplished by bulldozing the berms into the pits and then backfilling the pits, if required, to grade level. If the berms were inadequate to fill the pits completely, additional fill was brought in, usually from other parts of the station. Figure 2-2 shows a typical cross section for a closed pit.

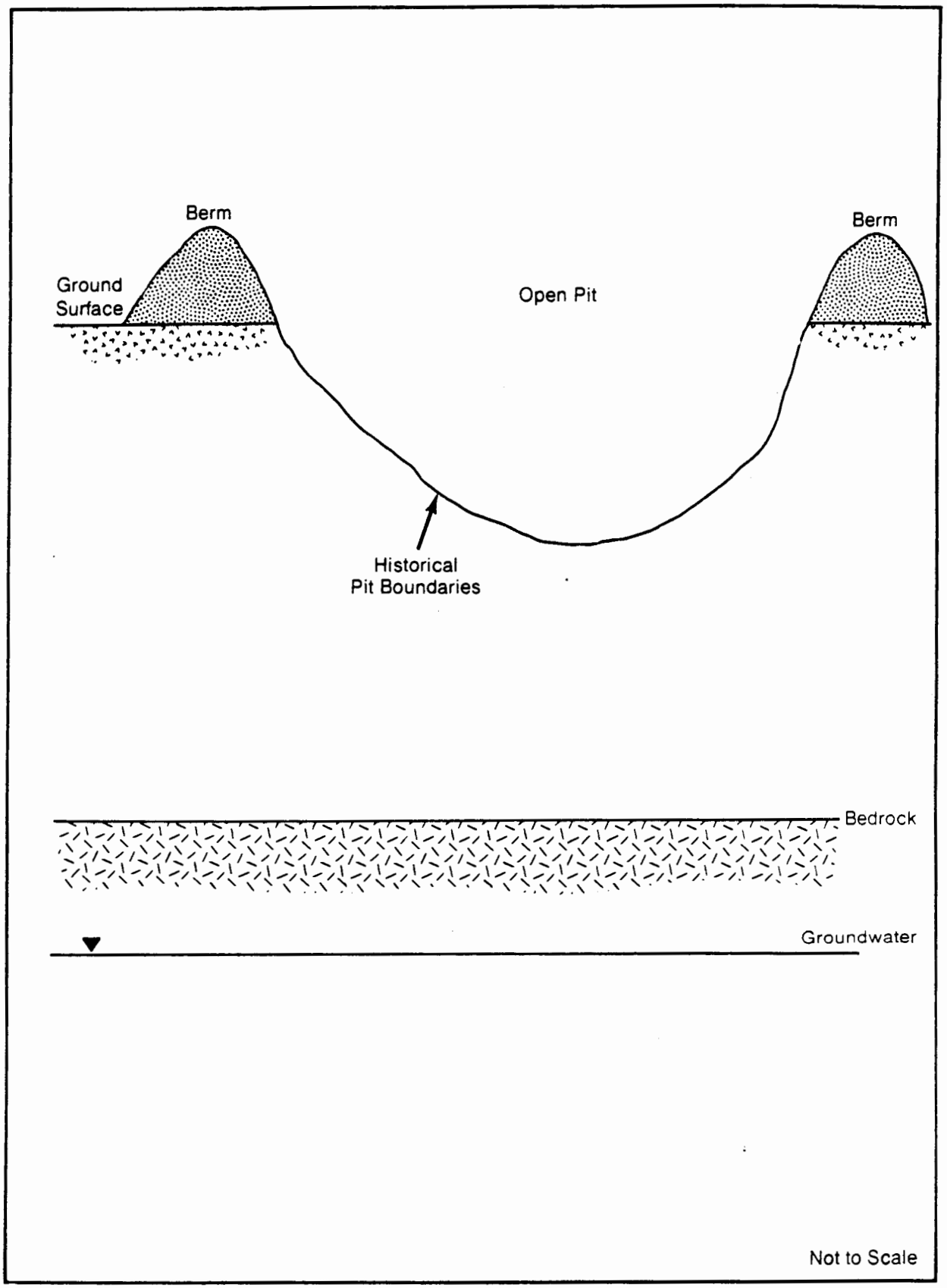


FIGURE 2-1 TYPICAL CROSS SECTION FOR OPEN PITS AT THE PENNSYLVANIA SITES

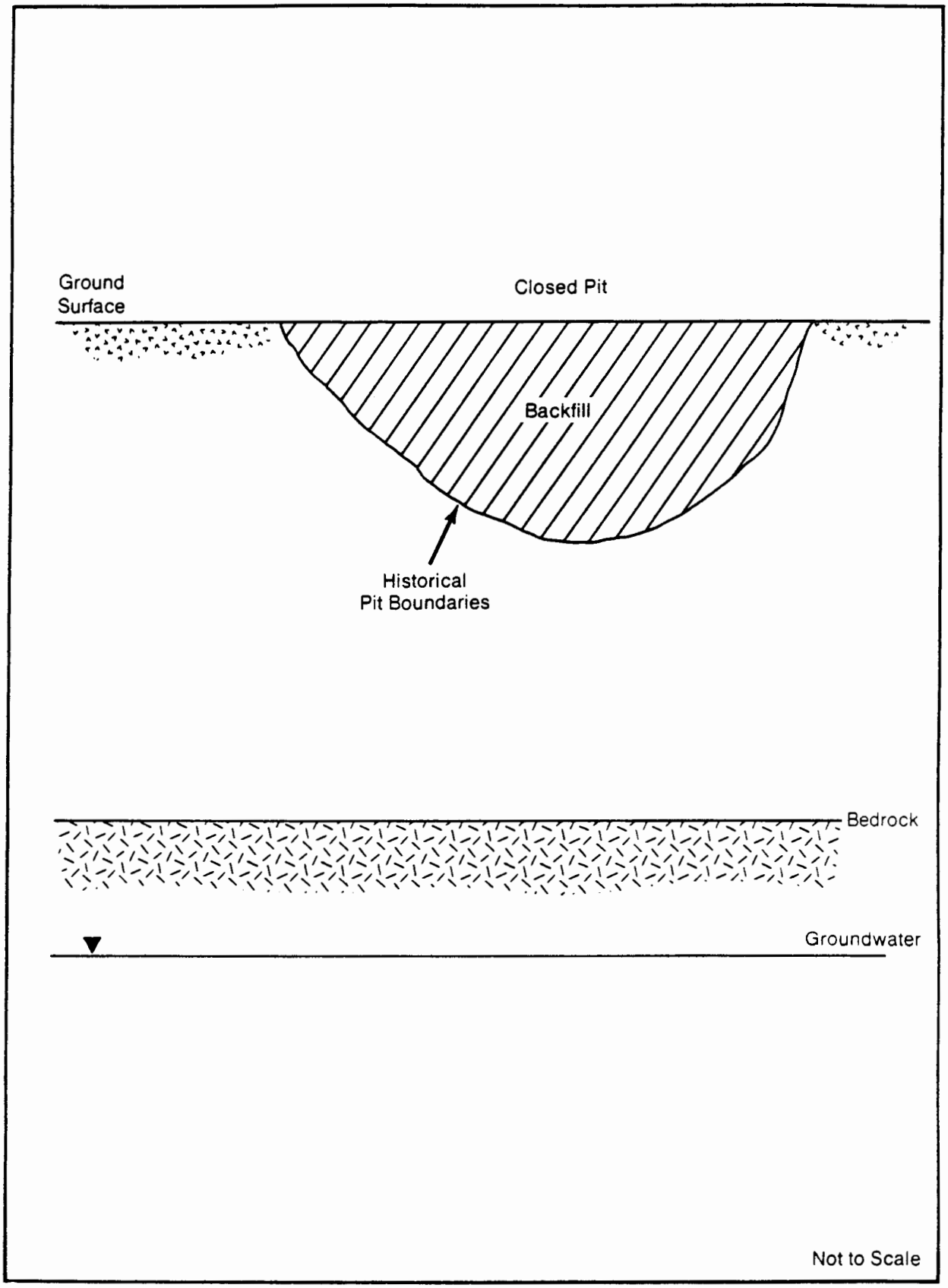


FIGURE 2-2 TYPICAL CROSS SECTION FOR CLOSED PITS AT THE PENNSYLVANIA SITES

The present method of handling pipeline liquids (e.g., from gas/liquid scrubbers, pigging, etc.) and lubricating oils from other site operations consists of temporary, secure storage in above-ground tanks and subsequent removal by a licensed waste hauler for disposal at a permitted facility.

2.3 SOIL BORING PROGRAM

2.3.1 Background

A soil boring program for the pits was conducted at the Pennsylvania Sites to determine the presence of polychlorinated biphenyls (PCBs) and other compounds in soils inside the pits and outside of, and adjacent to, the pits. The soil boring program was conducted by WESTON with field work performed during July and August 1986 and April and May 1987. As indicated in Table 2-1, a total of 81 soil borings were installed to investigate 27 pits at the Pennsylvania Sites.

The pits at the Bechtelsville and Delmont station sites were investigated in 1986 as part of the 8 Pilot Site Program. The results of this study were presented in:

- Results of the Supplementary 8 Pilot Site Compressor Station Investigation Program (WESTON, March 1987).
- Summary of Dioxin Sampling and Analysis: Texas Eastern Gas Pipeline Company Compressor Stations (WESTON, January 15, 1987).

The pits at the other 16 Pennsylvania Sites were investigated in 1987 in compliance with Paragraph 15(a) of the Consent Order. The results of this study were presented in:

- Summary Report for the Soil Boring Program at Sixteen Pennsylvania Sites (WESTON, August 11, 1987).
- Chlorinated Dibenzo-p-dioxin/Chlorinated Dibenzofuran Data for Composite Soil Boring Samples at Sixteen Pennsylvania Sites (WESTON, September 30, 1987).

Each of the above reports has been submitted to the Department.

Table 2-1

Summary of the Pit Soil Boring Program at the Pennsylvania Sites

Site	Number of Pits Investigated	Pit Designation	Number of Soil Borings Per Site		
			Inside Pit	Ouside Pit	Total
Armagh	2	PA-ARM-01 PA-ARM-02	4	2	6
Bechtelsville	1	PA-BEC-01	2	1	3
Bedford	1	PA-22A-01	2	1	3
Chambersburg	1	PA-023-01	2	1	3
Connellsville	4	PA-21A-01 PA-21A-02 PA-21A-03 PA-21A-04	8	4	12
Delmont	1	PA-DEL-01	2	1	3
Eagle	1	PA-025-02	2	1	3
Entriken	1	PA-ENT-01	2	1	3
Grantville	1	PA-GRA-01	2	1	3
Holbrook	3	PA-HOL-01 PA-HOL-02 PA-HOL-03	6	3	9
Lilly	1	PA-LIL-01	2	1	3
Marietta 24	1	PA-024-01	2	1	3
Marietta 24A	1	PA-24A-01	2	1	3
Perulack	2	PA-PER-01 PA-PER-02	4	2	6

Table 2-1
(continued)

Site	Number of Pits Investigated	Pit Designation	Number of Soil Borings Per Site		
			Inside Pit	Ouside Pit	Total
Rockwood	1	PA-022-01	2	1	3
Shermans Dale	2	PA-SHE-01 PA-SHE-02	4	2	6
Uniontown	1	PA-021-01	2	1	3
Wind Ridge	2	PA-020-01 PA-020-02	4	2	6
Total	27		54	27	81

The objectives of the soil boring program for the pits were to:

- Determine the vertical distribution of PCBs and the presence of other U.S. EPA Hazardous Substance List (HSL) compounds at two soil boring locations within each pit. The HSL compounds are listed in Exhibit C of the Consent Order and consist of organic compounds (volatiles, semivolatiles, pesticides, and PCBs) and inorganic compounds (metals and cyanide).

- Determine the presence of chlorinated dibenzo-p-dioxin/chlorinated dibenzofuran (CDD/CDF) compounds at two soil boring locations within each pit.

- Determine the vertical distribution of PCBs and the presence of other HSL compounds at one soil boring location outside and downslope of each pit.

- Determine the lithology of soils within, and downslope of, each pit.

To meet the objectives of the soil boring program, the following work was typically performed:

- Two soil borings were installed within the historical bounds of each pit. These borings were installed using hollow-stem augers and were sampled continuously with 1.5-foot or 2-foot split-spoon samplers. The borings were constructed to a depth of approximately 10 feet below the estimated bottom of the pit (maximum depth of approximately 20 feet below grade level), auger refusal, or the water table, whichever occurred first. Each split-spoon sample was analyzed for PCBs, and two samples per boring (one within the pit and one below the estimated bottom of the pit) were analyzed for HSL compounds. One composite sample per boring was analyzed for CDD/CDF.

- One soil boring was installed outside of each pit along the centerline of the pit approximately 25 feet downslope of the pit. These borings were installed following the same methods utilized for the borings located within the historical bounds of the pits. Each split-spoon sample was analyzed for PCBs, and two samples per boring (corresponding to the approximate depth intervals sampled within the pit) were analyzed for HSL compounds.

In many instances, representatives of the Department observed the installation of the soil borings for the pits.

The following subsections summarize and discuss the results of the soil boring program for the pits. The discussion of results is directed towards defining the nature and distribution of HSL compounds found during the soil boring program of the pits at the Pennsylvania Sites. The conclusions drawn are broad-based since they consider all the soil boring data for the Pennsylvania Sites. Evaluation and interpretation of the data on a site-specific basis are not provided at this time.

2.3.2 Nature of HSL Compounds Found

Table 2-2 summarizes the HSL compounds detected in the soil borings at the Pennslvania Sites. Values for total PCB, BTXE, and total BNA are also presented in this table. Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (base, neutral and acid-extractable compounds or BNA compounds), excluding phthalates, for each sample. Phthalates were not included in the sum for total BNA since these compounds are often used as plasticizers and, as such, are ubiquitous within the environment. They are also common laboratory and field contaminants. For purposes of calculating total PCB, BTXE, and total BNA, compounds not detected were assumed to have concentrations equal to zero.

2.3.2.1 Volatile Organic Compounds

For the volatile organic compounds (VOCs), 15 of the possible 35 HSL volatile compounds were detected in at least one of the 148 samples collected at the 18 sites during the soil boring program. Of those VOCs detected, the following compounds were present in approximately 10 percent or more of the samples analyzed.

- 1,1,1-Trichloroethane
- 2-Butanone
- Acetone
- Ethylebenzene
- Methyl Chloride
- Toluene
- Total Xylenes

Table 2-2
(continued)

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
Semivolatiles					
Benzo(K)Fluoranthene	1	148	0.550	0.550	0.550
Bis(2-Ethylhexyl)Phthalate	50	148	0.053	6.1	0.806
Butyl Benzyl Phthalate	5	148	0.048	3.2	0.846
Di-n-Butylphthalate	41	148	0.043	3.2	0.444
Di-n-Octylphthalate	4	148	0.064	1.5	0.506
Dibenzofuran	6	148	0.073	0.860	0.279
Fluoranthene	10	148	0.039	0.220	0.108
Fluorene	16	148	0.046	5.8	0.665
Isophorone	3	148	0.054	0.750	0.296
N-Nitrosodiphenylamine	15	148	0.086	7.1	0.712
Naphthalene	44	148	0.044	22	4.2
Phenanthrene	26	148	0.057	15	1.4
Phenol	6	148	0.083	38	6.7
Pyrene	18	148	0.044	2.4	0.360
2,4-Dinitrotoluene	1	148	0.063	0.063	0.063
2-Chlorophenol	1	148	1.4	1.4	1.4
2-Methylnaphthalene	57	148	0.120	49	5.6
3,3-Dichlorobenzidine	2	148	0.170	0.730	0.450

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).
[2]Samples include routine and duplicate samples.
[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[5]Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. Compounds not detected are assumed to have concentrations equal to zero.

Table 2-2
(continued)

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
4-Methylphenol	4	148	0.072	0.610	0.300
Acenaphthene	4	148	0.110	4.5	1.3
Acenaphthylene	4	148	1.4	35	17
Anthracene	4	148	0.052	0.690	0.214
Benzo(A)Anthracene	1	148	0.058	0.058	0.058
Benzo(A)Pyrene	3	148	0.120	0.580	0.283
Benzo(B)Fluoranthene	1	148	0.470	0.470	0.470
Total BNA[4]	50	148	0.460	88	13
Pesticides					
Endosulfan I	1	149	0.270	0.270	0.270
PCBs					
Aroclor 1016	5	553	1.2	140	39
Aroclor 1242	194	553	0.029	9,900	290
Aroclor 1248	133	553	0.035	5,700	340
Aroclor 1254	12	553	0.033	12,000	1,000
Aroclor 1260	1	553	0.040	0.040	40
Total PCB[5]	292	553	0.049	12,000	310

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).
[2]Samples include routine and duplicate samples.
[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[5]Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. Compounds not detected are assumed to have concentrations equal to zero.

Table 2-2
(continued)

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
Inorganics					
Aluminum	149	149	3.6	200	14
Arsenic	107	149	0.002	0.114	0.008
Barium	125	149	0.040	0.997	0.122
Beryllium	14	149	0.001	0.003	0.002
Cadmium	103	149	0.001	0.001	0.004
Calcium	145	149	0.118	130	3.8
Chromium	142	149	0.004	0.330	0.03
Cobalt	75	149	0.011	0.073	0.020
Copper	128	149	0.005	0.085	0.022
Iron	149	149	0.033	87	29
Lead	148	149	0.003	0.145	0.020
Magnesium	141	149	0.043	48	2.8
Manganese	149	149	0.048	11	0.818
Mercury	39	149	0.001	0.002	0.001
Nickel	134	149	0.008	0.084	0.023
Potassium	146	149	0.140	5.0	1.1
Selenium	3	149	0.002	0.003	0.002
Sodium	24	149	0.133	2.9	1.0
Thallium	2	149	0.004	0.004	0.004
Vanadium	137	149	0.011	0.084	0.028
Zinc	143	149	0.019	0.278	0.068

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).
[2]Samples include routine and duplicate samples.
[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[5]Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. Compounds not detected are assumed to have concentrations equal to zero.

Of these compounds, 2-butanone, acetone, and methylene chloride are common laboratory contaminants. Of the remaining compounds, only ethylbenzene and xylenes had average concentrations greater than 1 ppm. Other frequently detected volatile compounds with average concentrations less than 0.5 ppm included benzene, toluene, 1,1,1-trichloroethane and tetrachloroethene.

BTXE was detected in approximately 25 percent of the samples with a concentration range for the detected values between 0.009 and 75 ppm. The average BTXE concentration for the samples with detectable levels of benzene, toluene, xylenes, or ethylbenzene was approximately 10 ppm.

A pipeline liquids (condensate) sampling program was conducted by WESTON in April 1987 in compliance with Paragraph 13 of the Consent Order. The results of this program were transmitted to the Department in a letter report entitled "Results of Condensate Sampling at Four Pennsylvania Sites" (WESTON, June 1, 1987). The VOC data for the soil boring program agree with the results of the pipeline liquids (condensate) sampling program and indicate that benzene, toluene, xylenes, and ethylbenzene are the volatile organic contaminants of potential concern for the soils in the pits.

2.3.2.2 Semivolatile Organic Compounds

For the semivolatile organic compounds, 25 of the possible 65 HSL semivolatile compounds were detected in at least one of the 148 samples collected during the soil boring program for the pits at the Pennsylvania Sites. Six of the detected compounds were phthalates and will not be considered further in this discussion (see Subsection 2.3.2). Of the BNAs detected, the following compounds (excluding pthalates) were found in approximately 10 percent or more of the samples:

- Fluorene
- N-Nitrosodiphenylamine
- Naphthalene
- Phenanthrene
- Pyrene
- 2-Methylnaphthalene

Of these compounds, 2-methylnaphthalene and napthalene had the greatest frequency of detection (39 and 30 percent, respectively) and the highest average concentrations (5.6 and 4.2 ppm, respectively). The other frequently detected compounds, as listed above, all had average concentrations less than 1.5 ppm and were detected in less than 18 percent of the samples.

Other frequently detected semivolatile compounds included fluoranthene, dibenzofuran, and phenol (6, 4, and 4 percent detection frequency, respectively). The average concentrations for fluoranthene, dibenzofuran, and phenol were 0.108, 0.279 and 6.7 ppm, respectively.

The concentration range for the detected values of total BNA ranged between 0.406 and 88 ppm. BNA compounds were present in approximately 34 percent of the samples. The average concentration for total BNA was approximately 13 ppm.

The BNA data for the soil boring program are supported by the results of the pipeline liquids (condensate) sampling program. These data collectively show that naphthalene and 2-methylnaphthalene are the primary indicators of potential semivolatile organic constituents in the pits.

2.3.2.3 Pesticides

For the pesticides, only one of the possible 19 HSL pesticide compounds was detected in one of the 148 pit soil boring samples analyzed for these compounds. This compound was Endosulfan I and it was detected at a concentration of 0.270 ppm. Additionally, pipeline liquids (condensate) sampling data submitted to the Department indicated that no pesticide compounds were detected. Based on these data, pesticides are not contaminants of potential concern for the pits and will not be considered further.

2.3.2.4 PCB Compounds

For the PCB compounds, 5 of the possible 7 HSL Aroclors were detected in at least one of the 553 samples analyzed during the soil boring program for the pits at the Pennsylvania Sites. Aroclors 1221 and 1232 were not detected in any of the samples, while Aroclors 1016 and 1260 were present in less than one percent of the samples. Aroclor 1254 was found in approximately two percent of the samples. Of the remaining PCBs, Aroclors 1242 and 1248 were found in approximately 35 and 24 percent, respectively, of the samples analyzed.

The average concentrations for Aroclors 1242 and 1248 were each in the range of 290 to 340 ppm. The frequency of detection for total PCB was approximately 53 percent. The average total PCB concentration was approximately 310 ppm.

Aroclor 1254 had the highest average concentration of the PCBs detected (1,000 ppm). This average was skewed due to the maximum value found for Aroclor 1254 (12,000 ppm). Elimination of this one data point gives an average value of approximately 2 ppm for Aroclor 1254.

In summary, the soil boring data and the pipeline liquids (condensate) data indicate that total PCB is a concern and that the dominant Aroclors are 1242 and 1248.

2.3.2.5 Inorganic Compounds

For the inorganics, 21 of the possible 24 HSL inorganic compounds (metals and cyanide) were detected at least once in the 149 soil boring samples analyzed for the pits. Antimony, silver, and cyanide were not detected. The frequency of detection varied widely from approximately one percent for thallium to 100 percent for aluminum, iron, and manganese. The metals found in 75 percent or more of the samples included: aluminum, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, vanadium, and zinc. With the exception of aluminum, calcium, iron, magnesium, potassium, and sodium, all the metals detected have average concentrations less than 1 ppm. No metals were present at a significant level of concern. These results are consistent with data expected for soils since metals are natural constituents of soils. Based on these data, metals and cyanide are not contaminants of potential concern for the pits and will not be considered further.

2.3.2.6 CDD/CDF Compounds

Table 2-3 summarizes the CDD/CDF results for the soil boring program for the pits at the Pennsylvania Sites, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) isomer was not detected in any of the soil boring samples analyzed from the 27 pits investigated. It is generally accepted the 2,3,7,8-TCDD is that CDD/CDF isomer of greatest toxicological concern.

The CDD/CDF data for each sample were converted to total equivalent 2,3,7,8-TCDD concentrations following the procedure described in "Chlorinated Dibenzo-p-dioxin/Chlorinated Dibenzofuran Data for Composite Soil Boring Samples at Sixteen Pennsylvania Sites" (WESTON, September 30, 1987). The total equivalent 2,3,7,8-TCDD concentrations for each of the Pennsylvania Sites are provided in Table 2-3.

The total equivalent 2,3,7,8-TCDD concentrations for the Pennsylvania Sites ranged from 0 to 0.211 ppb. An action level of 1 ppb 2,3,7,8-TCDD has been recommended by the Centers for Disease Control (CDC) for cleanups in residential areas and this level has been applied extensively by the U.S. EPA for remediation of sites involving contamination of residential dwellings and soils in the vicinity of residential areas. Since

Table 2-3

Summary of Total Equivalent 2,3,7,8 - TCDD Concentrations
for the Pit Soil Boring Program at the Pennsylvania Sites

Site	Pit	Soil Boring	Total Equivalent 2,3,7,8-TCDD Concentration (ppb)
Armagh	PA-ARM-01	SB02	0.00664
		SB03	0.0193/0.00895
	PA-ARM-02	SB05	0.0000121
		SB06	0.0000217
Bechtelsville	PA-BEC-01	SB02	0
		SB03	0.184
Bedford	PA-22A-01	SB02	0/0.0000424
		SB03	0.0271
Chambersburg	PA-023-01	SB02	0
		SB03	0.0000222
Connellsville	PA-21A-01	SB11	0.000177
		SB12	0.000123
	PA-21A-02	SB09	0
		SB10	0.0000513
	PA-21A-03	SB04	0.0446
		SB05	0.00787/0.00559
	PA-21A-04	SB02	0.000541
		SB03	0.000851
Delmont	PA-DEL-01	SB01	0
		SB02	0/0
Eagle	PA-025-02	SB02	0
		SB03	0
Entriken	PA-ENT-01	SB02	0
		SB03	0.0000162/0.0000657
Grantville	PA-GRA-01	SB02	0.0959/0.151
		SB03	0.211
Holbrook	PA-HOL-01	SB02	0.000263
		SB03	0.00147/0.00125
	PA-HOL-02	SB08	0.00135
		SB09	0.00126
	PA-HOL-03	SB05	0.0000172
		SB06	0

Table 2-3
(continued)

Site	Pit	Soil Boring	Total Equivalent 2,3,7,8-TCDD Concentration (ppb)
Lilly	PA-LIL-01	SB02	0.00167
		SB03	0.00226/0.00425
Marietta 24	PA-024-01	SB02	0.0000505
		SB03	0/0
Marietta 24A	PA-24A-01	SB02	0.0000634
		SB03	0
Perulack	PA-PER-01	SB05	0.0225/0.0109
		SB06	0.00256
	PA-PER-02	SB02	0.0188
		SB03	0.0407
Rockwood	PA-022-01	SB02	0.0000323/0
		SB03	0
Shermans Dale	PA-SHE-01	SB02	0.00448
		SB03	0.0942/0.0723
	PA-SHE-02	SB05	0.00880
		SB06	0.0174
Uniontown	PA-021-01	SB01	0/0
		SB02	0
Wind Ridge	PA-020-01	SB05	0.0000411
		SB06	0.00318
	PA-020-02	SB02	0.0000252/0.0000156
		SB03	0.000433

Notes: Results for the Bechtelsville and Delmont sites are based on discrete samples. Results for all other sites are based on composite samples.

In cases where two values are shown in the same row, the second value corresponds to a duplicate sample.

The CDC/EPA action level for 2,3,7,8-TCDD is 1 ppb.

the maximum total equivalent 2,3,7,8-TCDD concentrations for the soil boring samples for the pits from the Pennsylvania Sites are less than the CDC/EPA action level, CDD/CDF will not be considered further.

2.3.3 Distribution of HSL Compounds Found

2.3.3.1 Areal Distribution

Table 2-4 presents a summary of results for non-PCB HSL organic compounds for the soil boring program of the pits at the Pennsylvania Sites. This table summarizes data for indicator compounds for VOCs (benzene, toluene, xylenes, ethylbenzene, and BTXE) and BNAs (2-methylnaphthalene, naphthalene, and total BNAs). The data are presented for all borings, borings inside the pits, and borings outside the pits.

The data show that at least 85 percent of the detects for the VOC and BNA indicator compounds occurred in samples collected from borings located inside the pits. In all cases, the frequency of detection of the indicator compounds was lower for the borings outside the pits than for borings inside the pits. For example, benzene was not detected in any of the samples from borings outside the pits. The maximum concentrations for all of the VOC and BNA indicator compounds were associated with samples collected from borings inside the pits. The average concentrations for VOC and BNA compounds detected inside the pits were up to two orders of magnitude greater than the average concentrations for the borings outside the pits.

Comparison of the results for VOC and BNA indicator compounds for borings inside and outside the pits show that the non-PCB HSL organics of concern are largely confined to samples collected from borings located inside the pits. This conclusion is supported by both frequency of detection and maximum and average concentration data.

Table 2-5 summarizes the PCB results for the soil boring program of the pits at the Pennsylvania Sites. Data are provided for total PCB and individual Aroclors for all borings, borings inside the pits, and borings outside the pits.

Approximately 70 percent of the detects for total PCB occurred in samples collected from borings located inside the pits. The frequency of detection of the PCBs is generally greater for borings inside the pits compared to the borings outside the pits.

Table 2-4

Summary of Non-PCB HSL Organic Results for the
Pit Soil Boring Program at the Pennsylvania Sites

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
All Borings:					
Benzene	9	148	0.001	4.0	0.509
Toluene	26	148	0.001	4.0	0.246
Xylenes (total)	38	148	0.001	75	8.7
Ethylbenzene	35	148	0.004	14	1.8
BTXE[3]	38	148	0.009	75	10
2-Methylnapthalene	57	148	0.120	49	5.6
Napthalene	44	148	0.044	22	4.2
Total BNA[4]	50	148	0.460	88	13
Borings Inside Pit:					
Benzene	9	102	0.001	4.0	0.509
Toluene	20	102	0.001	4.0	0.316
Xylenes (total)	32	102	0.001	75	10
Ethylbenzene	29	102	0.004	14	2.2

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).
[2]Samples include routine and duplicate samples.
[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[5]NA=Not applicable.

Table 2-4
(continued)

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
BTXE	33	102	0.010	75	12
2-Methylnapthalene	48	102	0.140	49	6.0
Napthalene	40	102	0.044	22	4.0
Total BNA	44	102	0.460	88	14
Borings Outside Pit:					
Benzene	0	46	NA[5]	NA	NA
Toluene	6	46	0.001	0.053	0.009
Xylenes (total)	6	46	0.009	0.450	0.189
Ethylbenzene	6	46	0.004	0.400	0.101
BTXE	5	46	0.009	0.850	0.341
2-Methylnapthalene	9	46	0.120	24	3.4
Napthalene	4	46	0.460	14	4.1
Total BNA	6	46	0.700	38	7.9

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).
[2]Samples include routine and duplicate samples.
[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[5]NA=Not applicable.

Table 2-5

Summary of PCB Results for the Pit Soil Boring Program
at the Pennsylvania Sites

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
All Borings:					
Aroclor 1016	5	553	1.2	140	39
Aroclor 1242	194	553	0.029	9,900	290
Aroclor 1248	133	553	0.035	5,700	340
Aroclor 1254	12	553	0.033	12,000	1,000
Aroclor 1260	1	553	0.040	0.040	0.040
Total PCB[3]	292	553	0.049	12,000	310
Borings Inside Pit:					
Aroclor 1016	3	373	1.2	140	54
Aroclor 1242	138	373	0.029	9,900	400
Aroclor 1248	97	373	0.035	5,700	460
Aroclor 1254	7	373	0.050	12,000	1,700
Aroclor 1260	0	373	NA[4]	NA	NA
Total PCB	210	373	0.049	12,000	420
Borings Outside Pit:					
Aroclor 1016	2	180	6.3	29	18
Aroclor 1242	56	180	0.040	580	46
Aroclor 1248	36	180	0.083	600	26
Aroclor 1254	5	180	0.033	6.3	1.5
Aroclor 1260	1	180	0.040	0.040	0.040
Total PCB	82	180	0.100	600	36

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).
[2]Samples include routine and duplicate samples.
[3]Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[4]NA = Not applicable.

The maximum concentrations for all Aroclors detected (except Aroclor 1260) as well as total PCB were found in samples from borings located inside the pits. The average concentra- tions for Aroclors 1242 and 1248 and total PCB showed a decrease of approximately one order of magnitude for borings outside the pit as compared to borings inside the pit.

Comparison of the PCB data in Table 2-5 with the data presented in Table 2-4 shows that the maximum and average concentrations of PCBs are typically two orders of magnitude greater than the values observed for non-PCB HSL indicator compounds. This indicates that total PCB is well suited for use as an indicator parameter to define the extent of contamination during future characterization investigations and site cleanups for soils.

The PCB data for samples from soil borings inside the pits and outside the pits indicate that PCBs are generally found in borings located inside the pits. These results, along with data for VOC and BNA indicator compounds, indicate that no significant lateral migration of contaminants downslope of the pits has occurred.

2.3.3.2 Vertical Distribution

Table 2-6 summarizes the total PCB, BTXE, and total BNA data for the soil boring program of the pits at the Pennsylvania sites. Data are presented for the upper HSL samples (collected within the estimated historical boundaries of the pit) and the lower HSL samples (collected below the estimated historical bottom of the pit) for all borings, borings inside the pits, and borings outside the pits.

For both the upper and lower samples, at least 68 percent of all the detects for total PCB, BTXE, and total BNA were associated with the samples collected inside the pits. In general, the frequency of detection for the lower samples decreased compared to the upper samples for both the borings inside and outside the pits.

The values for the maximum and average concentrations for total PCB, BTXE, and total BNA generally showed a decreasing trend as follows:

- Upper samples inside the pits.
- Lower samples inside the pits.
- Upper samples outside the pits.
- Lower samples outside the pits.

Table 2-6

Summary of PCB, BTXE, and BNA Results for the Pit Soil Boring Program at the Pennsylvania Sites

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
All Borings:					
Upper Samples:					
Total PCB[3]	57	85	0.120	2,200	210
BTXE[4]	30	91	0.009	75	7.6
Total BNA[5]	34	91	0.490	54	14
Lower Samples:					
Total PCB	30	84	0.130	4,300	180
BTXE	8	57	0.018	72	20
Total BNA	16	57	0.460	88	12
Borings Inside Pit:					
Upper Samples:					
Total PCB	39	57	0.170	2,200	260
BTXE	25	63	0.010	75	9.0
Total BNA	30	63	0.490	54	14
Lower Samples:					
Total PCB	25	57	0.140	4,300	220
BXTE	8	39	0.018	72	20
Total BNA	14	39	0.046	88	13

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).

[2]Samples include routine and duplicate samples.

[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.

[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.

[5]Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. Compounds not detected are assumed to have concentrations equal to zero.

[6]NA = Not applicable.

Table 2-6
(continued)

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
Borings Outside Pit:					
Upper					
Total PCB	18	28	0.120	600	110
BXTE	5	28	0.009	0.850	0.341
Total BNA	4	28	1.0	38	11
Lower Samples:					
Total PCB	5	27	0.130	34	7.0
BTXE	0	18	NA[6]	NA	NA
Total BNA	2	18	0.700	2.1	1.4

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).
[2]Samples include routine and duplicate samples.
[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[5]Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. Compounds not detected are assumed to have concentrations equal to zero.
[6]NA = Not applicable.

For the inside and outside pit borings, the maximum and average concentrations for total PCB, BTXE, and total BNA were generally within the same order of magnitude for the upper and lower samples. However, comparison of the data for upper and lower samples collected inside the pits and outside the pits generally showed an order of magnitude decrease for the samples outside the pit.

For all types of samples, average values for BTXE and total BNA were typically within the same concentration range (9 to 20 ppm for samples collected from borings inside the pit and below 11 ppm for borings outside the pit). In all cases, the average values for total PCB were one to two orders of magnitude greater than the average concentrations for BTXE and total BNA.

The data for the upper and lower samples show the following:

- For upper and lower samples from borings inside the pits, values of organic compounds were generally within the same concentration range. This indicates that, in some cases, contaminants may have moved vertically below the historical pit boundaries.

- A decrease of one order of magnitude in contaminant concentrations and a decrease in detection frequency have been typically observed between the upper and lower samples outside the pit. This indicates that no significant vertical migration of contaminants has occurred outside the pits.

- Maximum and average concentrations of organic compounds for upper and lower samples inside the pits are an order of magnitude greater than respective samples outside the pits. This further confirms the previous conclusion that no significant lateral movement of contaminants has occurred in a downslope direction from the pits.

- The average concentrations for BTXE and total BNA at discrete depth intervals are typically within the same range; however, they are significantly less than the average concentrations for total PCB. This further supports the prior conclusion that total PCB should be used as the primary indicator parameter to define the extent of soil contamination during additional site characterization studies and cleanups.

2.3.4 Site Conditions Summary

Table 2-7 summarizes the pit depths based on the soil boring logs. It also summarizes the PCB concentrations at the pit bottom and at the deepest depth interval sampled in the borings inside and outside the pits. Depths to bedrock and groundwater are also provided. Depth to bedrock, if encountered, was determined by auger refusal during construction of soil borings. The depth to groundwater, if encountered, was determined from the pit boring logs.

For 21 of the pits, the greatest PCB concentration corresponding to the depth of the pit was greater than 1 ppm. PCBs were detected at levels greater than 1 ppm in the deepest interval sampled for 12 pits for borings inside the pits and for 4 pits for borings outside the pits. The PCB concentrations at the deepest interval sampled for borings outside the pits were typically less than those for borings inside the pits.

2.3.5 Conclusions

Based upon the results presented for the soil boring program for the pits at the Pennsylvania Sites, the following general conclusions are presented:

- Of the HSL compounds detected in the soil borings for the pits, those detected most frequently and in the highest concentrations include: total PCB; for VOCs, benzene, toluene, total xylenes and ethylbenzene; and for BNAs, naphthalene and 2-methylnaphthalene.

- The results of the soil boring program for the pits are consistent with the previous results for the pipeline liquids (condensate) sampling program in terms of the compounds of potential concern.

- The frequency of detection and concentration of HSL compounds, other than the indicator parameters, indicate that those other compounds are not of potential concern.

- The maximum total equivalent 2,3,7,8-TCDD concentrations for the soil borings of the pits are all less than the CDC/EPA action level of 1 ppb.

- The PCBs, VOC and BNA indicator parameters show that no significant lateral migration of these parameters has occurred downslope of the pits.

Table 2-7

Summary of Site Conditions for Pits at the Pennsylvania Sites

Site	Pit	Pit Depth and Greatest Corresponding PCB Concentration		Deepest Interval Sampled and Corresponding PCB Concentration				Depth to Bedrock[3] (ft)	Depth to Groundwater[3] (ft)
				Borings Inside Pit		Borings Outside Pit			
		Depth[1] (ft)	PCB Concentration[2] (ppm)	Depth (ft)	PCB Concentration[2] (ppm)	Depth (ft)	PCB Concentration[2] (ppm)		
Armagh	PA-ARM-01	8	1,600	10-12	200	14-16	ND	10.4	NE[4]
	PA-ARM-02	8	0.03	14-16	ND	10-12	0.036	16	12
Bechtelsville	PA-BEC-01	4	250	20-22	270	20-22	ND	NE	NE
Bedford	PA-22A-01	10	12,000	10-12	5.9	6-8	ND	10.7	NE
Chambersburg	PA-023-01	4	0.68	4-6	0.18	2-4	ND	5	NE
Connellsville	PA-21A-01	8	31	12-14	BMQL	18-20	ND	NE	14
	PA-21A-02	8	29	14-16	0.072	18-20	BMQL	NE	16
	PA-21A-03	8	3,400	12-14	BMQL,B	12-14	21B	13	NE
	PA-21A-04	8	300	10-12	BMQL	12-14	32	12	NE
Delmont	PA-DEL-01	4.5	1,800	16.5-17	ND	10-12	BMQL	16.8	NE
Eagle	PA-025-02	4	49	8-10	0.22	6-8	7.1	NE	10
Entriken	PA-ENT-01	4	0.51	4-6	BMQL	2-4	BMQL	5.25	NE
Grantville	PA-GRA-01	3.5	1,900B	2-4	1,900B	4-6	BMQL,B	3.5	NE

[1]Based on pit soil boring logs.

[2]ND = not detected; BMQL = below minimum quantification limit; B = present in blank.

[3]Based on soil boring logs for borings located inside the pit.

[4]NE = not encountered.

Table 2-7
(continued)

Site	Pit	Pit Depth and Greatest Corresponding PCB Concentration		Deepest Interval Sampled and Corresponding PCB Concentration				Depth to Bedrock[3] (ft)	Depth to Groundwater[3] (ft)
				Borings Inside Pit		Borings Outside Pit			
		Depth[1] (ft)	PCB Concentration[2] (ppm)	Depth (ft)	PCB Concentration[2] (ppm)	Depth (ft)	PCB Concentration[2] (ppm)		
Holbrook	PA-HOL-01	8	4.4	8-10	14	6-8	ND	8.5	NE
	PA-HOL-02	6	19	6-8	82	14-16	0.25	6.9	NE
	PA-HOL-03	8	ND	8-10	ND	6-8	ND	9.6	NE
Lilly	PA-LIL-01	4	3,000	8-10	69	4-6	0.40	8.7	NE
Marietta 24	PA-024-01	6	0.45	16-18	ND	16-18	ND	16.25	NE
Marietta 24A	PA-24A-01	6	16	12-14	35	16-18	ND	15	NE
Perulack	PA-PER-01	4	990	8-10	78	4-6	ND	9	NE
	PA-PER-02	4	4,300	4-6	46	4-6	34	NE	4.5
Rockwood	PA-022-01	6	2.5B	18-20	ND	16-18	0.13	NE	NE
Shermans Dale	PA-SHE-01	8	1,000	10-12	53	14-16	ND	11.25	NE
	PA-SHE-02	10	830	10-12	35	12-14	ND	10.5	NE
Uniontown	PA-021-01	6	ND	14-16	ND	14-16	ND	15.5	NE
Wind Ridge	PA-020-01	4	550	18-20	ND	18-20	ND	NE	NE
	PA-020-02	4	2.6	12-14	0.15	8-10	ND	14.2	NE

[1]Based on pit soil boring logs.

[2]ND = not detected; BMQL = below minimum quantification limit; B = present in blank.

[3]Based on soil boring logs for borings located inside the pit.

[4]NE = not encountered.

- The PCBs, VOC and BNA indicator parameters show that, for samples inside the pits, in some cases, vertical migration of these parameters has occurred below the pits. For samples outside the pits, no significant vertical migration of these indicator parameters has occurred.

- Typically, concentrations of PCBs are significantly greater (orders of magnitude) than concentrations of other HSL compounds (i.e., VOCs and BNAs).

- PCBs should be used as the primary indicator parameter to define the extent of soil contamination during future site characterizations and cleanups.

Table 2-2

HSL Compounds Detected in the Pit Soil Boring Program
at the Pennsylvania Sites

Compound	Number of Detects[1]	Number of Samples[2]	Range and Average Concentration of Detected Values		
			Minimum (ppm)	Maximum (ppm)	Average (ppm)
Volatiles					
1,1,1-Trichloroethane	14	148	0.001	0.640	0.900
2-Butanone	31	148	0.002	20	1.6
4-Methyl-2-Pentanone	1	148	0.019	0.019	0.019
Acetone	96	148	0.002	11	0.657
Benzene	9	148	0.001	4.0	0.509
Carbon Disulfide	5	148	0.001	2.8	0.562
Chloroform	4	148	0.001	0.140	0.060
Chloromethane	2	148	0.010	0.089	0.050
Ethylbenzene	35	148	0.004	14	1.8
Methylene Chloride	95	148	0.002	2.3	0.102
Styrene	1	148	0.001	0.001	0.001
Tetrachloroethene	9	148	0.001	0.074	0.014
Toluene	26	148	0.001	4.0	0.246
Total Xylenes	38	148	0.001	75	8.7
Trichloroethene	2	148	0.001	0.029	0.015
BTXE[3]	38	148	0.009	75	10

[1]Detects include all concentration values except those designated as ND (not detected), J (estimated value below the minimum quantification limit), and B (present in blank).

[2]Samples include routine and duplicate samples.

[3]BTXE represents the sum of the concentrations of benzene, toluene, xylenes (total), and ethylbenzene for each sample. Compounds not detected are assumed to have concentrations equal to zero.

[4]Total BNA represents the sum of the concentrations of the HSL semivolatile compounds (excluding phthalates) for each sample. Compounds not detected are assumed to have concentrations equal to zero.

[5]Total PCB represents the sum of the concentrations of the seven HSL Aroclors for each sample. Compounds not detected are assumed to have concentrations equal to zero.

SECTION 3

CLEANUP CRITERIA

3.1 INTRODUCTION

This section presents cleanup criteria for pits at the Pennsylvania Sites consistent with the requirements of Paragraph 15(b) of the Consent Order. In addition, this section provides volume estimates of pit soils on two bases: (1) historical pit dimensions; and (2) cleanup criteria. The cleanup verification program for pits is also discussed.

3. 2 CLEANUP CRITERIA

In developing the cleanup plan for the pits at the Pennsylvania Sites, WESTON and Texas Eastern evaluated a variety of approaches and cleanup criteria. For ease of implementation and in order to provide a high degree of confidence with respect to complete cleanup of the pits at the Pennsylvania Sites, WESTON and Texas Eastern have selected a cleanup approach that calls for the complete removal of all soils from within the historical boundaries (the dimensions of the pit as originally constructed) of each pit. Pits will be removed provided PCBs have been found in the pit soil borings at concentrations greater than 1 ppm (detectable concentrations). Accordingly, the initial criteria for cleanup of the pits at the Pennsylvania Sites are: (1) if PCB levels greater than 1 ppm are found within the pits, then (2) removal of all soils within the historical pit boundaries.

These initial cleanup criteria exceed the most restrictive standards that Texas Eastern is required to address under the terms of Paragraph 15(b) of the Consent Order, because they will result in the complete and total removal of all soils within the pits, if the soils were found to have detectable (> 1 ppm) levels of PCBs. In contrast, a cleanup approach based solely on the levels of PCBs found in the soils within the historical pit boundaries could well result in only a partial removal of soils contained in the pits. Such an approach would potentially result in the removal of lesser amounts of soils from the pits than the approach proposed herein. By completely excavating all soil and other material from the pits, a major potential source of contamination at the Pennsylvania Sites will be removed.

In addition to this qualitative approach to the cleanup of the pits at the Pennsylvania Sites, which alone fully complies with the terms of Paragraph 15(b) of the Consent Order, Texas Eastern proposes to address in a quantitative manner the PCBs that have been detected in soils adjacent to the historical pit boundaries (residual PCBs). Consistent with the Agreement in Principle reached between Texas Eastern and the U.S. Environmental Protection Agency (EPA) on November 9, 1987, after excavating the entire contents of pits with PCB concentrations greater than 1 ppm, Texas Eastern proposes to clean up residual PCBs found outside the historical boundaries of the pits using the following criteria:

1. Excavation of soils beyond the historical pit boundaries shall continue until a level of 25 ppm of PCBs is reached, unless any one of the following first occur:

   a. Bedrock is reached.

   b. Groundwater is encountered.

   c. The excavation reaches 25 feet below ground surface.

2. Subject to the limitations of 1(a), (b), (c) above, if site characterization shows that all remaining detectable PCBs present below the pit are located within one foot of the historical pit bottom, excavation shall continue to a maximum of an additional one foot below the historical pit bottom.

This combined cleanup approach not only complies with Paragraph 15(b) of the Consent Order, but also provides a cleanup plan that addresses residual PCBs consistent with Federal requirements.

A summary of the cleanup criteria as applied to each of the 27 pits investigated in the Pennsylvania Sites is provided in Table 3-1. This table compares pit depths as determined from pit soil boring logs to the estimated excavation depths based on the cleanup criteria. Applying these cleanup criteria to the soil boring data from the 27 pits investigated, 19 of the pits and underlying soils will be subject to cleanup to detectable levels (1 ppm) of PCBs because: (1) no excavation is necessary; or (2) excavation will continue to bedrock; or (3) excavation will remove all soils to detectable levels.

Table 3-1

Summary of Pit Depths and Excavation Depths Based on Combined Cleanup Criteria for Pits at the Pennsylvania Sites

Site	Pit	Pit Depth (ft)[1]	Estimated Excavation Depth Based on Cleanup Criteria	Cleanup Criteria Applied
Armagh	PA-ARM-01	8	10.4	Bedrock
	PA-ARM-02	8	8	Historical pit depth (13 ppm PCBs)
Bechtelsville	PA-BEC-01	4	>22	25 ppm or 25 feet
Bedford	PA-22A-01	10	10.7	Historical pit depth + 1 foot and bedrock
Chambersburg	PA-023-01	4	4	Historical pit depth (< 1 ppm PCBs)
Connellsville	PA-21A-01	8	9	Historical pit depth + 1 foot
	PA-21A-02	8	10	25 ppm
	PA-21A-03	8	8	25 ppm
	PA-21A-04	8	10	25 ppm
Delmont	PA-DEL-01	4.5	13.5	25 ppm
Eagle	PA-025-02	4	5	Historical pit depth + 1 foot
Entriken	PA-ENT-01	4	No excavation required	No PCBs > 1 ppm

Table 3-1
(continued)

Site	Pit	Pit Depth (ft)[1]	Estimated Excavation Depth Based on Cleanup Criteria	Cleanup Criteria Applied
Grantville	PA-GRA-01	3.5	3.5	Bedrock
Holbrook	PA-HOL-01	8	8.5	Historical pit depth + 1 foot
	PA-HOL-02	6	6.9	Bedrock
	PA-HOL-03	8	No excavation required	No PCBs > 1 ppm
Lilly	PA-LIL-01	4	8.7	Bedrock
Marietta 24	PA-24-01	6	No excavation required	No PCBs > 1 ppm
Marietta 24A	PA-24A-01	6	15	Bedrock
Perulack	PA-PER-01	4	9	Bedrock
	PA-PER-02	4	4	Bedrock
Rockwood[2]	PA-022-01	6	6	Historical pit depth
Shermans Dale	PA-SHE-01	8	11.25	Bedrock
	PA-SHE-02	10	10.5	Bedrock
Uniontown	PA-021-01	6	No excavation required	No PCBs > 1 ppm
Wind Ridge	PA-020-01	4	5	Historical pit depth + 1 foot
	PA-020-02	4	6	25 ppm

[1]Based on pit soil boring logs.
[2]Subject to additional confirmatory soil borings for this pit to clarify data anomalies from the April - May 1987 pit boring program.

3.3 PIT VOLUMES ESTIMATES

Estimated historical pit volumes and soil excavation volumes based on the cleanup criteria are presented in Table 3-2 for the 27 pits investigated during the soil boring program at the Pennsylvania Sites. Two volume estimates are provided for each pit and the methodology and dimensions used to estimate these volumes are summarized as follows and are presented in Appendix A in further detail:

- The estimated historical pit volumes are based on historical pit diameters available from Texas Eastern's records and pit depths as determined by WESTON based on a review of the soil boring logs for each of the pits. Using these dimensions, the historical pit volumes are calculated, assuming that the pit is a cylinder. In addition, perimeter side slope of 2:1 (vertical:horizontal) are included in the estimate to account for conventional construction practices.

- The estimated soil excavation volumes for the pits utilize the depths obtained by applying the cleanup criteria (see Table 3-1) along with the above surface dimensions. The calculation of the estimated excavation volumes assumes that the pit is cylindrical with modifications based on pit and site characteristics. Perimeter side slopes of 2:1 are also included.

As shown on Table 3-2, the total estimated historical pit volumes and soil excavation volumes for the pits and surrounding soils at the Pennsylvania Sites applying the combined cleanup criteria are approximately 3,900 and 11,500 cubic yards (c.y.), respectively. This confirms that Texas Eastern's proposal, using the combined cleanup criteria, will result in the removal of substantially more soil than would be required under the terms of Paragraph 15(b) of the Consent Order.

Table 3-3 provides a summary of the estimated historical pit volumes and soil excavation volumes for the pits. The estimated soil excavation volumes per site range from 0 to approximately 6,000 c.y., with an average of approximately 640 c.y. The average estimated soil excavation volume per pit is approximately 460 c.y.

Table 3-2

Estimated Volumes for Pits at the
Pennsylvania Sites

Site	Pit Designation	Estimated Volume (c.y.) Historical Pit	Soil Excavation
Armagh	PA-ARM-01	50	79
	PA-ARM-02	50	50
Site Total		100	129
Bechtelsville	PA-BEC-01	57	882
Bedford	PA-22A-01	92	103
Chambersburg	PA-023-01	120	120
Connellsville	PA-21A-01	273	1,890
	PA-21A-02		
	PA-21A-03		
	PA-21A-04	1,457	4,158
Site Total		1,730	6,048
Delmont	PA-DEL-01	66	573
Eagle	PA-025-02	120	853
Entriken	PA-ENT-01	18	0
Grantville	PA-GRA-01	49	49
Holbrook	PA-HOL-01	88	97
	PA-HOL-02	192	1,016
	PA-HOL-03	88	0
Site Total		368	1,113

Table 3-2
(continued)

Site	Pit Designation	Estimated Volume (c.y.) Historical Pit	Soil Excavation
Lilly	PA-LIL-01	18	57
Marietta 24	PA-024-01	355	0
Marietta 24A	PA-24A-01	94	355
Perulack	PA-PER-01	57	163
	PA-PER-02	57	239
Site Total		114	402
Rockwood	PA-022-01	32	32
Shermans Dale	PA-SHE-01	138	226
	PA-SHE-02	190	204
Site Total		328	430
Uniontown	PA-021-01	192	0
Wind Ridge	PA-020-01	57	323
	PA-020-02	35	59
Site Total		92	382
Total All Sites		3,945	11,514

Table 3-3

Summary of Estimated Volumes
for Pits at the Pennsylvania Sites

	Estimated Volume (c.y.)	
	Historical Pit	Soil Excavation
Total for 18 Sites	3,945	11,514
Range Per Site	18 - 1,730	0 - 6,048
Average Per Site	220	639
Range Per Pit	18 - 1,457	0 - 4,158
Average Per Pit	158	461

Table 3-4 categorizes the Pennsylvania Sites on the basis of the range of estimated soil excavation volumes per site. The sites were grouped using the following three classifications:

- Sites with estimated soil excavation volumes less than 250 c.y.
- Sites with estimated soil excavation volumes between 200 and 500 c.y.
- Sites with estimated soil excavation volumes greater than 500 c.y.

Five of the sites (Bechtelsville, Connellsville, Delmont, Eagle, and Holbrook) have estimated soil excavation volumes greater than 500 c.y. Fifty percent of the sites have estimated soil excavation volumes less than 250 c.y.

3.4 CLEANUP VERIFICATION

A cleanup verification program will be performed for the pits at the Pennsylvania Sites and will consist of two components.

The first component of the pit cleanup verification program will apply to the seven (7) pits that will be excavated to historical pit boundaries and the historical pit depth plus 1 foot, and will consist of a survey of the excavation. The survey of the excavation following removal of the soils in the pit will provide the information required to confirm that the extent of excavation was adequate. This will enable verification of removal of soils to the appropriate dimensions. If the survey results indicate that the appropriate dimensions have not been achieved, additional excavation will be undertaken to ensure complete removal to the required dimension.

The second component of the pit cleanup verification program will involve soil sampling to ensure that the 25 ppm level of PCBs has been achieved. This component will consist of sampling the soils immediately surrounding the perimeter of the completed excavations and analysis of the soils for PCBs. Sampling will be consistent with the plan submitted pursuant to Paragraph 17(a) of the Consent Order.

If the 25 ppm level of PCBs is exceeded, further removal of soils will be performed in the direction in which the PCBs were found. Excavation and sampling may be performed repetitively, until the PCB concentration does not exceed 25 ppm. Excavation will be stopped if bedrock, groundwater, or a 25-foot total excavation depth is reached prior to achieving the 25 ppm level of PCBs.

Table 3-4

Range of Estimated Soil Excavation Volumes Per Site
for the Pennsylvania Sites

Estimated Excavation Volume Per Site (c.y.)	Average Estimated Excavation Volume Per Pit (c.y.)	Number of Pits	Number of Sites	Sites
0 - < 250	49	10	9	Armagh, Bedford, Chambersburg, Entriken, Grantville, Lilly, Marietta 24, Rockwood, Uniontown
200 - 500	225	7	4	Marietta 24A, Perulack Shermans Dale, Wind Ridge
> 500	947	10	5	Bechtelsville, Connellsville, Delmont, Eagle, Holbrook

APPENDIX A

METHODOLOGY FOR ESTIMATING HISTORICAL PIT VOLUMES AND SOIL EXCAVATION VOLUMES AT THE PENNSYLVANIA SITES

OVERVIEW

Estimates of historical pit volumes and soil excavation volumes for the Pennsylvania Sites were calculated using the methodology described in this appendix. Three different models (Cases 1, 2, 3) were utilized to develop the volume estimates. Case 1 assumes that the pits are cylinders. This geometry was modified for Cases 2 and 3 to account for varying pit and site characteristics. All three models include perimeter side slopes of 2:1 (vertical:horizontal) to account for conventional construction practices.

Table A-1 presents the estimated historical pit volumes for the Pennsylvania Sites. All historical pit volumes were calculated using Case 1. Historical pit diameters were obtained from Texas Eastern's records. Historical pit depths were determined by WESTON based on a review of the soil boring logs for the pits.

Table A-2 presents the estimated soil excavation volumes for the Pennsylvania Sites. These volumes were calculated using Cases 1 to 3. As above, historical pit diameters were obtained from Texas Eastern's records and were used for the calculations. Pit depths were based on the soil boring data for the pits and the cleanup criteria described in Section 3.

Each of the models used for calculating the pit volumes is described below.

CASE 1

The Case 1 model consists of a cylindrical excavation sloped on its perimeter at a 2V:1H ratio. This geometry and the equations for the volume calculation are presented in Figure A-1. Case 1 was used to estimate all the historical pit volumes and the soil excavation volumes when the data for the soil borings outside the pits indicated no PCBs greater than 25 ppm.

CASE 2

The Case 2 model was used to estimate soil excavation volumes when the data for the soil boring outside the pit indicated 25 ppm PCB concentration at a depth less than that found in soil borings inside the pit. The geometry and equations

utilized for this case are illustrated in Figure A-2. This volume was estimated by taking the cross section shown in Figure A-2 and rotating it through an angle 2θ as shown in the plan view. The depths (inside H_1 and outside H_2) are the excavation depths based on the cleanup criteria.

CASE 3

The Case 3 model was used to estimate soil excavation volumes when the data for the soil boring outside the pit indicated 25 ppm PCB concentration at a depth equal to or greater than that found in the soil borings inside the pit and when a limiting situation was encountered at a greater depth outside of the pit than inside the pit. The geometry and equations for volume calculation under Case 3 are presented in Figure A-3. The pit geometry was expanded to include the out-of-pit boring, and the base of the excavation was sloped from H_1 to H_2.

Table A-1

Summary of Pit Dimensions and Volumes for Historical Information

Site	Pit	Historical Pit Dimensions Diameter[1] (ft)	Historical Pit Dimensions Depth[2] (ft)	Estimated Historical Pit Volume (c.y.)
Armagh	PA-ARM-01	10	8	50
	PA-ARM-02	10	8	50
Bechtelsville	PA-BEC-01	20	4	57
Bedford	PA-22A-01	12	10	92
Chambersburg	PA-023-01	30	4	120
Connellsville	PA-21A-01	30	8	273
	PA-21A-02			
	PA-21A-03	75	8	1,457
	PA-21A-04			
Delmont	PA-DEL-01	20	4.5	66
Eagle	PA-025-02	30	4	120
Entriken	PA-ENT-01	10	4	18
Grantville	PA-GRA-01	20	3.5	49
Holbrook	PA-HOL-01	15	8	88
	PA-HOL-02	30	6	192
	PA-HOL-03	15	8	88
Lilly	PA-LIL-01	10	4	18
Marietta 24	PA-24-01	42	6	355
Marietta 24A	PA-24A-01	20	6	94

[1]Determined from Texas Eastern's records.
[2]Determined from pit soil boring logs.

Table A-1
(continued)

Site	Pit	Historical Pit Dimensions		Estimated Historical Pit Volume (c.y.)
		Diameter[1] (ft)	Depth[2] (ft)	
Perulack	PA-PER-01	20	4	57
	PA-PER-02	20	4	57
Rockwood	PA-022-01	10	6	32
Shermans Dale	PA-SHE-01	20	8	138
	PA-SHE-02	20	10	190
Uniontown	PA-021-01	30	6	192
Wind Ridge	PA-020-01	20	4	57
	PA-020-01	15	4	35

[1]Determined from Texas Eastern's records.
[2]Determined from pit soil boring logs.

Table A-2

Summary of Pit Dimensions and Volumes for Cleanup Criteria

Site	Pit	Case	Historical Pit Diameter[1] (ft)	Depth Based on Cleanup Criteria[2] Inside Pit (ft)	Depth Based on Cleanup Criteria[2] Outside Pit (ft)	Estimated Soil Excavation Volume (c.y.)
Armagh	PA-ARM-01	1	10	10.4	--	79
	PA-ARM-02	1	10	8	--	50
Bechtelsville	PA-BEC-01	1	20	25	--	882
Bedford	PA-22A-01	1	12	10.7	--	103
Chambersburg	PA-023-01	1	30	4	--	120
Connellsville	PA-21A-01, PA-21A-02	3	30	10	10	1,890
	PA-21A-03, PA-21A-04	3	75	10	12.75	4,158
Delmont	PA-DEL-01	2	20	13.5	3	573
Eagle	PA-025-02	3	30	5	8	853
Entriken	PA-ENT-01	1	10	No excavation required		--
Grantville	PA-GRA-01	1	20	3.5	--	49
Holbrook	PA-HOL-01	1	15	8.5	--	97
	PA-HOL-02	3	30	6.9	10	1,016
	PA-HOL-03	1	15	No excavation required		--
Lilly	PA-LIL-01	1	10	8.7	--	57
Marietta 24	PA-24-01	1	42	No excavation required		--
Marietta 24A	PA-24A-01	1	20	15	--	355
Perulack	PA-PER-01	1	20	9	--	163
	PA-PER-02	3	20	4	6	239

[1]Determined from Texas Eastern's records.
[2]Determined from pit soil boring data and the cleanup criteria.

Table A-2
(continued)

Site	Pit	Case	Historical Pit Diameter[1] (ft)	Depth Based on Cleanup Criteria[2] Inside Pit (ft)	Depth Based on Cleanup Criteria[2] Outside Pit (ft)	Estimated Soil Excavation Volume (c.y.)
Rockwood	PA-022-01	1	10	6	--	32
Shermans Dale	PA-SHE-01	1	20	11.25	--	226
	PA-SHE-02	1	20	10.5	--	204
Uniontown	PA-021-01	1	30	No excavation required		--
Wind Ridge	PA-020-01	2	20	5	2	323
	PA-020-02	1	15	6	--	59

[1]Determined from Texas Eastern's records.
[2]Determined from pit soil boring data and the cleanup criteria.

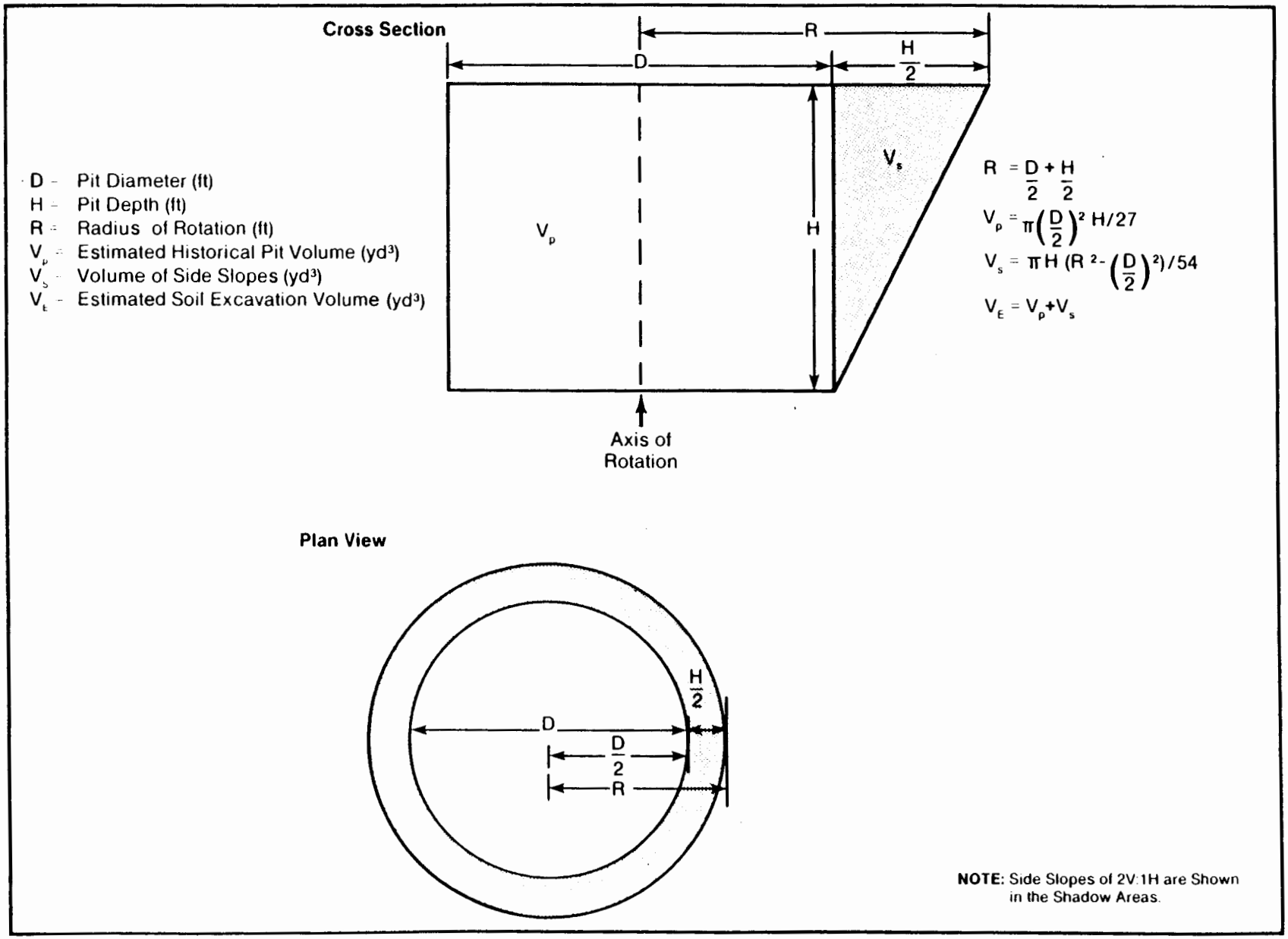
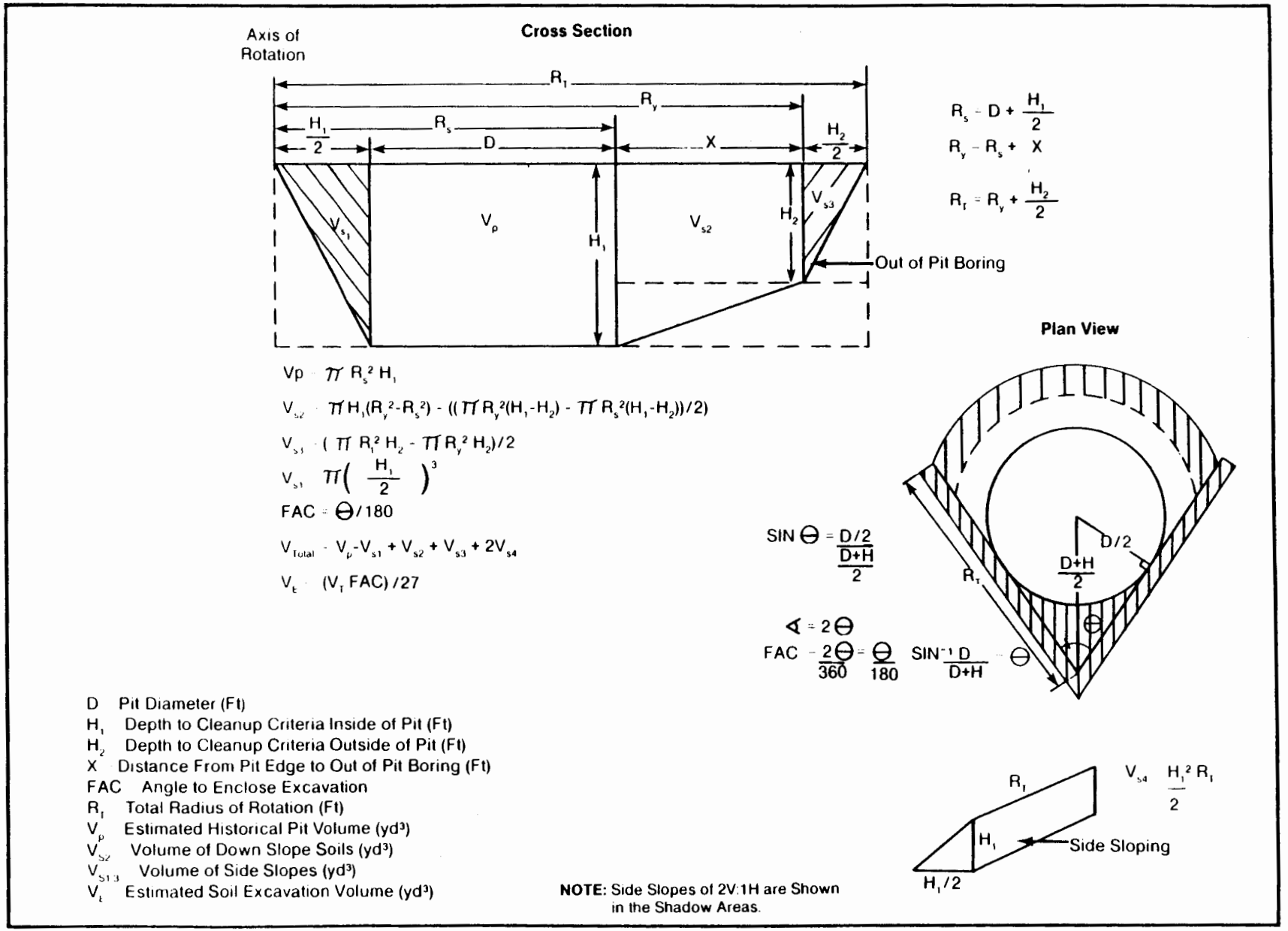


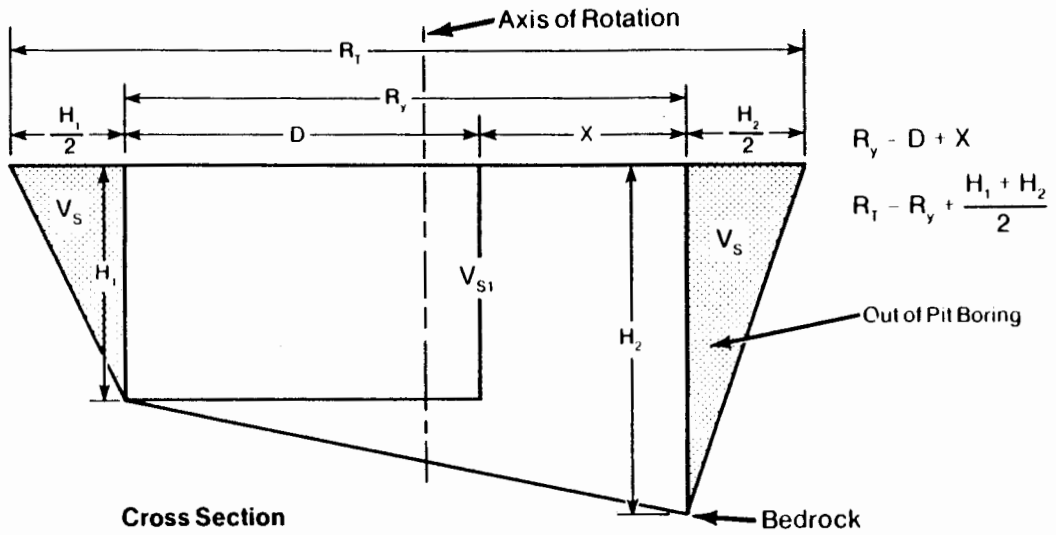
FIGURE A-1 CASE 1 - EXCAVATION GEOMETRY



D Pit Diameter (Ft)
H_1 Depth to Cleanup Criteria Inside of Pit (Ft)
H_2 Depth to Cleanup Criteria Outside of Pit (Ft)
X Distance From Pit Edge to Out of Pit Boring (Ft)
FAC Angle to Enclose Excavation
R_T Total Radius of Rotation (Ft)
V_p Estimated Historical Pit Volume (yd^3)
V_{S2} Volume of Down Slope Soils (yd^3)
$V_{S1,3}$ Volume of Side Slopes (yd^3)
V_t Estimated Soil Excavation Volume (yd^3)

NOTE: Side Slopes of 2V:1H are Shown in the Shadow Areas.

FIGURE A-2 CASE 2 - EXCAVATION GEOMETRY



$R_y = D + X$

$R_T = R_y + \frac{H_1 + H_2}{2}$

Cross Section

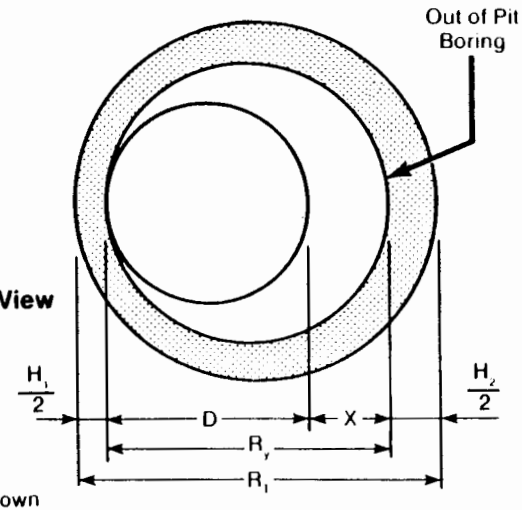
$V_{S1} = \pi(\frac{R_y}{2})^2 H_2 - \pi(\frac{R_y}{2})^2 (H_2 - H_1)/2$

$V_S = \pi \frac{R_T}{2} (H_2^2 - H_1^2)/2 + H_1^2)$

$V_T = V_S + V_{S1}$

$V_E = V_T/27$

Case 3A When In/Out of Pit Action
Level is on Bedrock



Plan View

D = Pit Diameter (Ft)
H_1 = Depth to Cleanup Criteria Inside of Pit (Ft)
H_2 = Depth to Cleanup Criteria Outside of Pit (Ft)
X = Distance From Pit Edge to Out of Pit Boring (Ft)
R_T = Surface Diameter (Ft)
V_S = Volume of Side Slopes (yd^3)
V_{S1} = Volume of Down Slope Soils (yd^3)
V_E = Estimated Soil Excavation Volume (yd^3)

NOTE: Side Slopes of 2V:1H are Shown in the Shadow Areas.

FIGURE A-3 CASE 3-EXCAVATION GEOMETRY

WESTON